NASA RESEARCH PRIORITIES

Earth System Variability & Trends: How are global precipitation, evaporation, and the cycling of water changing?

Earth System Responses & Feedback Processes: How can climate variations induce changes in the global ocean circulation?

Aquarius Salinity Measurements Will Provide the Missing Parameter that Links Two Major Climate System Components:

Global Water Cycle
Precipitation
Evaporation
Ice Freeze/Melt
Land Runoff

Ocean Circulation
Surface Height
Barrier Layers
El Niño/La Niña
Thermohaline Flow

Change
Water Flux
Impact
Seawater Density

86% of evaporation & 78% of precipitation occur over the ocean, dominating the water cycle

Changes in global ocean circulation & heat transport have lasting climate impact

Aquarius Sea Surface Salinity (SSS)
Measured in practical salinity units (psu)

- *Salinity responds to changes in the surface water fluxes and, in turn, alters the surface density field that drives ocean currents*
- *Observing ocean salinity is the only way to measure how water cycle changes effect the ocean & its circulation*

Aquarius Science Goal – To understand the regional and global processes that couple changes in the water cycle and ocean circulation and influence present and future climate.

Science Objectives:

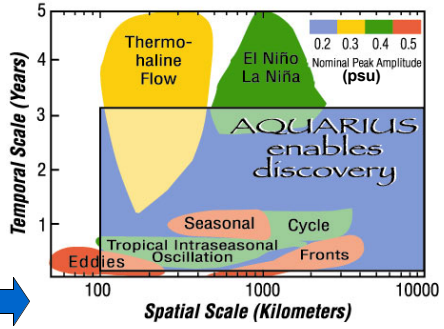
Observing seasonal cycles & year-to-year variability

Discovery & Exploration
Salinity mapping of unmeasured regions and features unknown to science

Water Cycle
Salinity response to surface water fluxes

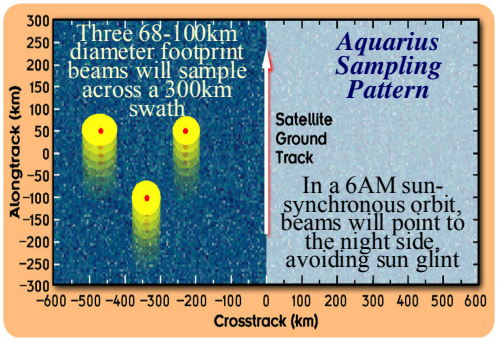
Ocean Circulation & Climate
- **Tropics** Climate feedback processes, El Niño, La Niña
- **Mid-Latitudes** Subduction and mode water formation
- **High-Latitudes** Deep water formation processes

Aquarius Measurement Objectives: Resolve key ocean and climate phenomena at 100 km and larger spatial scales, monthly and longer time scales.

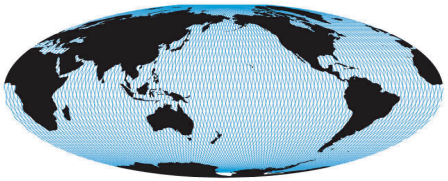


AQUARIUS SYSTEM

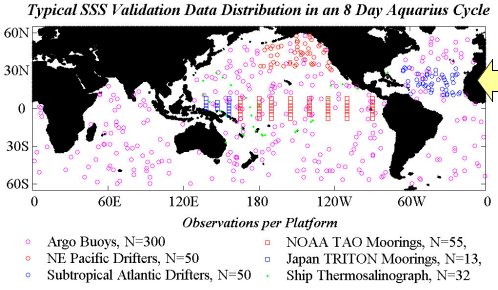
- **Baseline mission:** 3 years, 100km, 0.2 psu, monthly; ensures that year-to-year variations and a statistically reliable mean seasonal cycle will be measured
- The ***Aquarius*** 8-day repeat period will provide enough samples to obtain a mean monthly 0.2 psu accuracy over the globe



***Aquarius* Swath Gives Global Coverage in 8 Days**

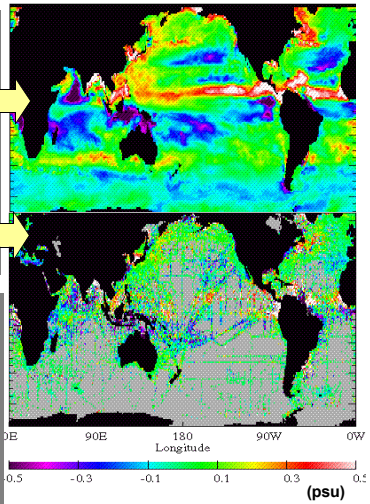


Aquarius satellite data will be merged with an extensive surface validation network (below) to produce a calibrated global SSS analysis for the public within 8 days of observation.

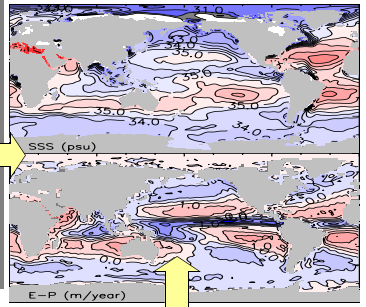


SCIENTIFIC RETURN

Aquarius will reveal details of global SSS variability, as shown with the March-April-May map from an ocean model. Compare with lower map that shows all historical data for March-April-May.



***Aquarius* will aid understanding of:**
- Seasonal cycle & mixing in climate models
- Salinity transport by currents
- Ocean state & freshwater budget
- SSS impact on tropical climate models & El Niño
- SSS impact on ocean subsurface dynamics
- Ice-ocean interaction
- Processes that keep the Atlantic relatively salty



Surface salinity is linked to the water cycle: Mean SSS is highest where evaporation exceeds precipitation (E-P >0), and is lowest where there is excess precipitation, especially in the tropics

It's the right time for Aquarius:
- Global array of profiling floats will follow surface salinity and density response at depth
- *Aquarius* will complete a satellite-based climate observing system (i.e., rain, wind, sea level, sea surface temperature)